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### Title

Development of the PROMIS Social Motivations for Smoking item banks.

### Permalink

<https://escholarship.org/uc/item/9z38k1xk>

### Journal

Nicotine & tobacco research : official journal of the Society for Research on Nicotine and Tobacco, 16 Suppl 3(Suppl 3)

### ISSN

1462-2203

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### Publication Date

2014-09-01

### DOI

10.1093/ntr/ntt283

Peer reviewed

## ORIGINAL INVESTIGATION

# Development of the PROMIS<sup>®</sup> Social Motivations for Smoking Item Banks

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Received September 9, 2013; accepted December 20, 2013

## ABSTRACT

**Introduction:** Smoking behavior is influenced by social motivations such as the expected social benefits of smoking and the social cues that induce craving. This paper describes development of the PROMIS<sup>®</sup> Social Motivations for Smoking item banks, which will serve to standardize assessment of these social motivations among daily and nondaily smokers.

**Methods:** Daily ( $N = 4,201$ ) and nondaily ( $N = 1,183$ ) smokers completed an online survey. Item factor analyses, item response theory analyses, and differential item functioning analyses were conducted to identify a unidimensional set of items for each group. Short forms (SFs) and computer adaptive tests (CATs) were evaluated as tools for more efficiently assessing this construct.

**Results:** A total of 15 items were included in the item banks (9 items common to daily and nondaily smokers, 3 unique to daily, 3 unique to nondaily). Scores based on full item banks are highly reliable (reliability = 0.90–0.91). Additionally, the item banks are strongly unidimensional and perform similarly across gender, age, and race/ethnicity groups. A fixed SF for use with both daily and nondaily smokers consists of 4 items (reliability = 0.80). Results from simulated CATs showed that, on average, fewer than 5 items are needed to assess this construct with adequate precision using the item banks.

**Conclusions:** A new set of items has been identified for assessing the social motivations for smoking in a reliable, standardized manner for daily and nondaily smokers. In addition to using the full item banks, efficient assessment can be achieved by using SFs, employing CATs, or selecting items tailored to specific research or clinical purposes.

## INTRODUCTION

The PROMIS<sup>®</sup> Smoking Initiative is using state-of-the-art measurement techniques to develop psychometrically sound item banks that will allow for standardized assessment of cigarette smoking behavior and biopsychosocial constructs associated with smoking. In the initial qualitative phase of this project, described elsewhere (Edelen, Tucker, Shadel, Stucky, & Cai, 2012), a pool of relevant items assessing smoking behavior and related constructs was compiled using systematic literature review and classification, focus groups to identify gaps in item coverage, and one-on-one cognitive interviews with smokers to identify potential problems in item wording and response options. This resulting pool of items was field tested, and six distinct preliminary item banks were identified through exploratory factor analyses based on field test data from over 3,000 daily smokers. One of the preliminary banks included a set of items that pertained to the beliefs that: (a) smoking makes social situations more comfortable or enjoyable; (b) smoking provides a sense of camaraderie and

belonging; (c) quitting smoking can negatively impact existing relationships with smokers; and (d) being in certain social situations increases smoking or the temptation to smoke. In considering the item content as a whole, we labeled this set of items the Social Motivations for Smoking (heretofore referred to simply as Social Motivations). This paper describes the process of developing the PROMIS Social Motivations item banks for daily and nondaily smokers.

Social motivations for smoking can include a smoker's internalized expectancies about the consequences of smoking or quitting on social interactions or relationships (Shadel, Shiffman, Niaura, Nichter, & Abrams, 2000). Such outcome expectancies about smoking are key constructs in conceptual models of cigarette smoking (e.g., Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Brandon, Herzog, Irvin, & Gwaltney, 2004; Niaura, Goldstein, & Abrams, 1991; Witkiewitz & Marlatt, 2004). Several studies have specifically examined how these expectancies are associated with smoking-related behaviors in adults. For example, some research indicates that adults with stronger expectancies that smoking will facilitate

doi:10.1093/ntr/ntt283

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their interactions with others tend to smoke more heavily (Rohsenow et al., 2003) and report greater nicotine dependence (Copeland, Brandon, & Quinn, 1995), although the association with dependence has not been entirely consistent (Rohsenow et al., 2003). Other work has found that adults who have stronger expectations about the social facilitative effects of smoking tend to experience greater craving and withdrawal symptoms, even after controlling for dependence (Vidrine et al., 2009). However, they are not necessarily less likely to make a quit attempt (Rohsenow et al., 2003) or more likely to relapse after quitting (Vidrine et al., 2009).

In addition to these internalized expectancies about smoking, social motivations for smoking encompass external factors such as environmental cues for smoking. These cues include, for example, seeing other people smoking or being in social settings where one typically smokes (García-Rodríguez et al., 2011; Niaura et al., 1998). Exposure to these types of cues has been associated with craving and/or smoking behavior across a range of studies (e.g., Scarinci, Silveira, dos Santos, & Beech, 2007; Surawy, Stepney, & Cox, 1985; Zhou et al., 2009), including those using ecological momentary assessment to identify the immediate antecedents of smoking and relapse (e.g., Shiffman, Paty, Gnys, Kassel, & Hickcox, 1996; Shiffman, Paty, Gwaltney, & Dang, 2004). In clinical settings, topics often include treatment modules that help smokers to manage social situations and other smokers without smoking (Brown, 2003). Taken together, this literature highlights the clinical relevance of this construct and the importance of being able to assess it in a standardized, reliable, and efficient manner.

The various social motivations for smoking have been measured with an array of different instruments. For example, the Smoking Consequences Questionnaire for adults (Copeland et al., 1995) includes a Social Facilitation subscale with items such as “I feel more at ease with other people if I have a cigarette” and “I feel like part of a group when I’m around other smokers.” The Smoking Effects Questionnaire (Rohsenow et al., 2003) has a similar subscale labeled Positive Social Effects, which includes items such as “Smoking gives me something to do with my hands in a group” and “Smoking helps me feel more relaxed when I am with other people.” The Perceived Risks and Benefits Questionnaire (McKee, O’Malley, Salovey, Krishnan-Sarin, & Mazure, 2005), which assesses smokers’ perceived risks of quitting, includes a Social Ostracism subscale with items such as “I will be less welcome around my friends who smoke” and “I will feel uncomfortable around smokers.” In addition, several measures include items assessing the extent to which being around other smokers increases the desire to smoke or would make it more difficult to quit (e.g., Berlin et al., 2003; Centers for Disease Control and Prevention, 2012; DiFranza, Wellman, Ursprung, & Sabiston, 2009).

As these examples illustrate, a number of existing instruments focus on particular aspects of the social experience of smoking. However, no single instrument fully captures this multifaceted construct. By conducting an exhaustive review of existing instruments, in addition to obtaining expert and layperson input, the PROMIS Smoking Initiative aimed to identify and evaluate the “best of the best” item content in order to generate a psychometrically sound assessment tool that researchers and practitioners can use to assess the social motivations for smoking. In this paper, we first describe the analyses we conducted to arrive at a unidimensional set of items assessing this construct for daily and nondaily smokers, which included

item factor analyses, item response theory (IRT) analyses, and differential item functioning (DIF) analyses to identify any differences by gender, age, and race/ethnicity. This is followed by a discussion of how we developed and evaluated the performance of short forms (SFs) and computer adaptive tests (CATs) to increase both efficiency and flexibility in reliably assessing the social motivations for smoking. Our analysis plan mirrors the procedures described by Reeve et al. (2007) to psychometrically evaluate and calibrate health-related quality of life item banks for PROMIS. Additional details on the analytic process that we used to develop the Social Motivations item banks for daily and nondaily smokers can be found in this supplement (Hansen et al.).

## METHODS

### Sample and Procedure

A national sample of smokers ( $N_{\text{total}} = 5,384$ ;  $N_{\text{daily}} = 4,201$ ;  $N_{\text{nondaily}} = 1,183$ ) was recruited by Harris Interactive through their online panel membership, and all assessments were completed via the Internet. All procedures were approved by institutional review boards. Individuals were eligible if they were 18 years or older, had been smoking for at least a year, had smoked in the past 30 days, and did not have plans to quit in the next 30 days. Based on their response to number of days smoked in past 30 days, those participants indicating smoking 28–30 of the past 30 days were classified as daily smokers and respondents smoking less than 28 of the past 30 days were classified as nondaily smokers. Sample recruitment was targeted to reflect the demographic composition of U.S. adult smokers in terms of gender, race/ethnicity, and age. The survey was fielded between July and September 2011 via a randomized block design (Reeve et al., 2007). The block design was constructed to minimize respondent burden while maximizing the inter-item covariance coverage. To cross-validate the dimensionality of the Social Motivations item bank, the daily smoker sample was randomly split into exploratory ( $N_{\text{exploratory}} = 3,021$ ) and confirmatory ( $N_{\text{confirmatory}} = 1,180$ ) subsamples.

Mean age was 46.4 years for daily (D) smokers and 44.1 years for nondaily (ND) smokers. Females comprised about half the sample (D: 54.8%, ND: 47.0%). Most participants were employed full-time (D: 52.9%, ND: 60.6%) or part-time (D: 12.2%, ND: 14.4%). The racial/ethnic composition was primarily non-Hispanic White (D: 72.2%, ND: 55.2%), African American (D: 12.1%, ND: 15.5%), and Hispanic (D: 11.3%, ND: 24.4%). Most participants had attended at least some college (D: 80.5%, ND: 84%), and many had earned a bachelors or graduate degree (D: 29.8%, ND: 42.1%). More than half were currently married or cohabitating (D: 57.7%, ND: 55.1%), with fewer being divorced/separated/widowed (D: 21.8%, ND: 18.7%) or never married (D: 20.5%, ND: 26.1%). Although most differences are not large, chi-square tests (and *t*-test for age) indicated that daily and nondaily smokers significantly differed on each of these characteristics ( $p < .001$ ). Most notably, relative to daily smokers, nondaily smokers were less likely to be non-Hispanic White, and more likely to be employed and further educated. Table 1 compares these groups on smoking patterns. As expected, daily smokers had a longer smoking history, smoked more cigarettes on average per day, and reported fewer quit attempts compared with nondaily smokers ( $p < .0001$ ).

**Table 1. Smoking Characteristics of Daily and Nondaily Smokers**

Smoking variable	Daily smokers ( <i>N</i> = 4,201)	Nondaily smokers ( <i>N</i> = 1,183)
Years smoked, %		
1–10	11.7	29.2
>10	88.3	70.8
Number of days smoked in past 30 days, %		
1–2	0.0	15.8
3–5	0.0	9.6
6–9	0.0	9.6
10–19	0.0	23.2
20–27	0.0	41.9
28–30	100.0	0.0
Average number of cigarettes per day in past 30 days, %		
<1 per day	0.2	13.0
1–5	8.0	48.3
6–10	22.0	22.3
11–20	47.3	13.5
20+	22.6	3.9
Number of times quit for at least 24 hr, %		
Never	18.0	14.7
1	12.3	6.2
2–3	30.7	19.1
4–5	19.7	12.7
6–9	7.4	7.8
10 or more times	12.0	40.1
Quitting contemplation, %		
Not thinking about quitting	40.1	42.3
Thinking about quitting, but no plans to quit	37.1	29.0
Plans to quit in next 6 months	22.7	28.7

## Measures

### Smoking Items

A total of 277 unique smoking items were administered. These items were developed according to PROMIS procedures from extant items in the literature as well as direct feedback from smokers. This process, described in more detail in Edelen et al. (2012), employed a rigorous qualitative approach that included systematic literature review, binning and winnowing of items, item standardization, solicitation of feedback from smokers via focus groups and cognitive interviews, and final item revisions. All respondents completed 13 of the 277 smoking items, which assessed their smoking behavior and quitting history. The remaining 264 items were candidate items that were being considered for inclusion in one of the smoking item banks. These items were distributed across 26 overlapping forms containing an average of 147 items (range = 134–158); each respondent was randomly assigned one of the 26 forms.

### Other Measures

All respondents supplied basic demographic information and completed one of eight PROMIS health-related quality of life SF measures (alcohol consumption, anger, anxiety, depression, fatigue, physical functioning, sleep disturbance, and global health; Cella et al., 2007). These PROMIS measures

were collected to provide preliminary validity evidence, and results are reported in this supplement (Edelen, Stucky, et al.).

## Item Factor Analyses

Previous analyses of the daily smoker exploratory subsample identified a set of 23 items to be considered for inclusion in the Social Motivations item bank for daily smokers (Edelen et al., 2012). The same 23 items were also considered for nondaily smokers.

Using the exploratory subsample of daily smokers (*N* = 3,021) and the full sample of nondaily smokers (*N* = 1,183), we examined the underlying factor structures of the 23-item sets with the software IRTPRO (Cai, du Toit, & Thissen, 2011a). Local dependence (LD) diagnostic indices (Chen & Thissen, 1997) and high-dimensional exploratory item factor analyses (Cai, 2010) were used to identify clusters of related items, or LD departures from unidimensionality. Item bifactor models (e.g., Cai, Yang, & Hansen, 2011b; Gibbons & Hedeker, 1992) were then specified to account for these LD clusters.

Examining model results for each smoker type, study team members evaluated item content within each specific factor in order to select subsets of items that would represent a unidimensional construct. We primarily considered each item's substantive content when selecting items, but additionally considered the item's loading on the social motivations factor, along with the percentage of common variance accounted for by the social motivations factor (i.e., item explained common variance or I-ECV; Stucky, Thissen, & Edelen, 2013).

After selecting items for inclusion and removal in this way, the dimensionality of the two resultant item sets was re-evaluated by testing the fit of a one-factor model using the Mplus software (Muthén & Muthén, 1998–2010) with weighted least squares mean- and variance-adjusted (WLSMV) estimation for categorical estimation for categorical response items and standard model fit indices and criteria (root mean squared error of approximation [RMSEA] ≤ 0.08, Tucker-Lewis index [TLI] ≥ 0.95, comparative fit index [CFI] ≥ 0.95; Browne & Cudeck, 1993; Hu & Bentler, 1999). For daily smokers, model fit was assessed first in the exploratory subsample (*N* = 3,021) and then confirmed using the validation subsample (*N* = 1,180); the analysis for nondaily smokers used the full nondaily sample (*N* = 1,183).

## Differential Item Functioning

After identifying and confirming two sufficiently unidimensional item sets to represent the social motivations construct, the item sets were further evaluated for DIF. These evaluations were conducted using the full daily (*N* = 4,201) and nondaily (*N* = 1,183) smoker samples with IRTPRO (Cai et al., 2011a). DIF was evaluated for significance according to gender, race/ethnicity (White, Black, Hispanic), and age (18–30, 31–50, 51+) using established procedures (Orlando Edelen, Thissen, Teresi, Kleinman, & Ocepek-Welikson, 2006; Orlando & Marshall, 2002). Items with significant DIF were further evaluated for “impact” by considering the weighted area between the expected score curves (wABC) and the expected difference in expected a posteriori score (dEAP) indices described in more detail in Hansen et al. Items with wABC values greater than 0.30 were screened for potential removal by evaluating graphical illustrations of the subgroups' expected score curves, along with the values of the wABC and dEAP indices. Items judged to have

nonignorable DIF were removed from further consideration in their respective item banks (i.e., daily or nondaily).

### Calibration of Item Banks

The Social Motivations item banks for daily and nondaily smokers were concurrently calibrated using data from the full combined sample ( $N = 5,384$ ,  $N_{(\text{daily})} = 4,201$ ,  $N_{(\text{nondaily})} = 1,183$ ). We estimated a two-group IRT model with groups distinguishing daily and nondaily smokers. This calibration, which specified the daily smokers as the reference group, fixed the daily social motivations mean to 0 and the *SD* to 1, and estimated unique nondaily mean and standard deviation. Following PROMIS standards, IRT scores were subsequently rescaled using the T-score metric to have a mean of 50 and a *SD* of 10 for daily smokers. The scale for the daily – nondaily group difference was set based on pre-identified anchor items whose parameter estimates were constrained to be equal across the groups. Item parameters for nonanchor items were estimated separately for the two groups (see Hansen et al. for more details). The utility of the item banks was determined using IRT-based test information, score precision, and marginal reliability (MR).

### Short Form Development

Item parameters from the final calibration were used in the development of a social motivations fixed-item SF. In order to simplify the administration and scoring of this form, only those items with equal parameters for daily and nondaily smokers (i.e., anchor items in the two-group calibration) were considered for SF inclusion. Among all the possible combinations of eligible items, candidate SFs were identified using selection criteria related to overall content balance, inclusion of items favored by the study team, and the reliability of score estimates across a broad range of the social motivations construct (see Hansen et al. for more detail). Following PROMIS procedures, SF scoring was based on a transformation of the sum of responses to SF items. The use of summed scores has the particular advantage of allowing for the creation of translation tables by which researchers may convert an observed sum into an IRT-scaled score (Thissen, Nelson, Rosa, & McLeod, 2001). The performance of the SFs was evaluated using simulated data. For both the daily and nondaily item banks, we examined the reliability of each SF and obtained correlations of SF scores with scores based on the patterns of responses to the full sets of items.

### CAT Simulation

CATs utilize item selection algorithms to select and administer items based on what is already known about the respondent from their responses to earlier items. Because items are tailored to the respondent's estimated standing on the measured construct, adaptive tests can often achieve high levels of score precision with far fewer items than fixed-length tests and thus can significantly reduce respondent burden (e.g., Gibbons et al., 2008). We conducted CAT simulations using Firestar (Choi, 2009) to evaluate the utility of computer adaptive administration of the daily and nondaily smoker Social Motivations item banks. These simulations: (1) provide an indication of the average number of items from the Social Motivations item banks that would be administered under typical CAT conditions, (2) indicate which items would be most routinely selected for CAT administration, and (3) characterize the expected CAT-based score reliability.

## RESULTS

### Item Factor Analyses

Bifactor models, each with five specific factors, were selected to characterize the structure of both the 23 daily smoker items (using the exploratory daily smoker sample) and the 23 nondaily smoker items. In both cases, these models were selected based on their interpretability, comparisons of fit indices, and LD chi-squares. The specific factors identified in the bifactor model represent the content “clusters” in the social motivations item sets (e.g., facilitating social interactions; fostering camaraderie; social cues to smoking; social influences on quitting; exposure to other smokers). The study team reviewed the bifactor model results for all 23 daily smoker and 23 nondaily smoker items and selected at least one item per specific factor to retain for further consideration in the item banks. Item selection was based on item content and the strength of the general factor loading.

This process led to the selection of 15 daily smoker items and 15 nondaily smoker items that balanced item content and closely represented the social motivations dimension. Next, one-factor models were fit to the selected item sets to confirm that they were sufficiently unidimensional. Relative to the original 23 daily smoker items (CFI = 0.85, TLI = 0.84, RMSEA = 0.10), the reduced set of 15 daily smoker items showed improved fit in both the exploratory and confirmatory subsamples (exploratory: CFI = 0.91, TLI = 0.90, RMSEA = 0.08; confirmatory: CFI = 0.93, TLI = 0.92, RMSEA = 0.07). MR was reduced from 0.95 to 0.91. Furthermore, in the exploratory subsample, the test-level ECV (Reise, 2012) associated with the social motivations (general) factor increased from 0.56 to 0.65 indicating a more strongly unidimensional model. Fit indices for the nondaily smokers also suggest a strongly unidimensional item set (CFI = 0.98, TLI = 0.97, RMSEA = 0.06), with improvement in fit compared with the 23-item set (CFI = 0.90, TLI = 0.89, RMSEA = 0.08) and minimal loss in precision (MR went from 0.95 to 0.91). Similar to daily smoker results, the ECV associated with the social motivations (general) factor in the nondaily sample solution increased from 0.66 to 0.80.

### Differential Item Functioning

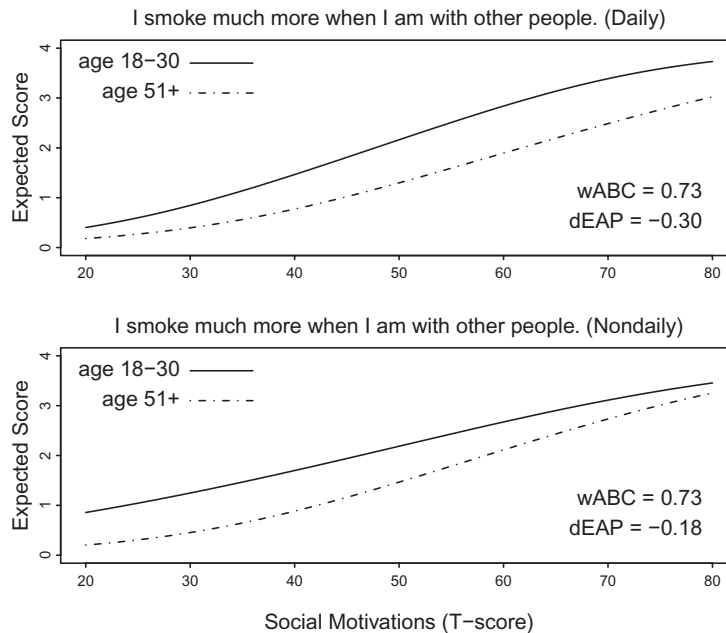
Next, the 15 daily and 15 nondaily smoker items underwent DIF testing according to gender, race/ethnicity (White, Black, Hispanic), and age (18–30, 31–50, 51+). For the daily smokers, across all comparisons, four items met the wABC criterion for consideration of removal (i.e., wABC > 0.30), and three items were ultimately removed because of DIF. For the nondaily smokers, five items were considered for removal, and three were ultimately removed. DIF information for the removed items is summarized in Table 2. Notably, two items were identified as having DIF in both the daily and nondaily smoker samples and thus removed from both item banks. Figure 1 displays the expected score curves for one of these items (“I smoke much more when I am with other people”), which had age DIF in both smoker groups. Examination of the curves shows that among both daily and nondaily smokers, younger respondents provided higher average ratings of this statement (compared with older respondents) at all levels of the social motivations construct continuum.



**Table 2.** Social Motivations Items Removed Because of DIF

Item stem	# Comparisons with wABC > 0.3	DIF variable	wABC	dEAP
<b>Daily smokers</b>				
I smoke much more when I am with other people	3	Age 18–30 versus age 51+	0.73	–0.30
		Age 18–30 versus age 31–50	0.39	–0.16
		Age 31–50 versus age 51+	0.36	–0.06
Smoking can be a good excuse to get out of uncomfortable social situations	2	Age 18–30 versus age 51+	0.49	–0.17
		Age 31–50 versus age 51+	0.32	0.11
Other people smoking around me would make it hard for me to quit	1	Female versus male	0.43	0.14
<b>Nondaily smokers</b>				
I smoke much more when I am with other people	2	Age 18–30 versus age 51+	0.73	–0.18
		Age 31–50 versus age 51+	0.41	–0.17
If I always smoke in a certain place it is hard to be there and not smoke	2	Hispanic versus White	0.42	0.17
		Hispanic versus Black	0.34	0.13
Other people smoking around me would make it hard for me to quit	1	Hispanic versus White	0.43	0.14

Note. dEAP = difference in expected a posteriori score; DIF = differential item functioning; wABC = weighted area between the expected score curves.



**Figure 1.** Item removed due to differential item functioning from both the daily and nondaily smoker Social Motivations item banks.

**Calibration of Item Banks**

Using the two-group IRT model with daily smokers as the reference group, 15 total items were calibrated. Within this set, seven were anchor items (identical item parameters for daily and nondaily smokers) and two had unique item parameters for daily and nondaily smokers. In addition, there were three items per bank that were nonoverlapping (i.e., items that only occur for that particular smoker group). This process resulted in two Social Motivations item banks (one for daily and one for nondaily smokers), each with a total of 12 items. As can be seen in Table 3, the final items tended to be strongly related to the underlying social motivations construct (*a* parameters for items in both banks ranged from 0.90 to 2.42) and covered a wide range of the social motivations continuum (*b* parameters

ranged from –1.95 to 4.61) that is fairly symmetric around the social motivations mean.

Figure 2 illustrates the score reliability for the daily and nondaily smoker Social Motivations item banks (and SF) on a standard T-score scale. Full bank scores have reliability values greater than 0.70 from more than 2 SDs below the mean to 3 SDs above the mean (i.e., from 30 to 80, in the T-score scale), and reliability is particularly high (~.90) from approximately 1 SD below to 2 SDs above the mean. Nondaily smokers had a mean value of 47.3, 0.27 SDs below the daily smoker mean of 50. In addition, the nondaily smoker sample had slightly more social motivations variability (*SD* = 11.03) compared with daily smokers (*SD* = 10).

**Table 3.** Social Motivations Item Banks for Daily and Nondaily Smokers

Item	D/ND	CAT		Item parameters				
		D	ND	<i>a</i>	<i>b</i> <sub>1</sub>	<i>b</i> <sub>2</sub>	<i>b</i> <sub>3</sub>	<i>b</i> <sub>4</sub>
Smoking makes me feel better in social situations. (SF)	Both	1.00	1.00	2.42	-.45	.21	1.07	1.75
Smoking helps me feel more relaxed when I'm with other people. (SF)	Both	1.00	1.00	2.35	-.83	-.06	.81	1.60
I feel like part of a group when I'm around other smokers. (SF)	Both	1.00	0.96	2.01	-.97	-.11	.73	1.52
I enjoy the social aspect of smoking with other smokers. (SF)	Both	0.97	0.67	1.36	-1.95	-.62	.55	1.58
I feel a bond with other smokers.	Both	1.00	0.76	1.45	-1.42	-.26	.78	1.75
Smoking is a part of my self-image.	Both	0.79	0.44	1.15	-.28	.85	2.09	3.08
If I quit smoking I will be less welcome around my friends who smoke.	Both	0.01	0.00	.90	1.70	2.46	3.75	4.61
I am tempted to smoke when I am with other people who are smoking. <sup>a</sup>	D <sup>b</sup>	0.96		2.20	-2.71	-1.97	-.64	.47
I am tempted to smoke when I am with other people who are smoking. <sup>a</sup>	ND <sup>b</sup>		0.32	1.04	-3.89	-2.34	-.29	1.48
Smoking gives me something to do with my hands.	D <sup>b</sup>	0.90		1.19	-2.04	-.76	.31	1.33
Smoking gives me something to do with my hands.	ND <sup>b</sup>		0.58	1.13	-1.44	-.19	.80	1.84
I am tempted to smoke when I see someone enjoying a cigarette. <sup>a</sup>	D	1.00		2.22	-2.28	-1.24	.10	1.12
If I always smoke in a certain place it is hard to be there and not smoke.	D	1.00		1.41	-1.69	-.95	.17	1.19
If I quit smoking I will feel uncomfortable around smokers.	D	0.08		.98	-.61	.33	1.48	2.41
Smoking helps me enjoy people more.	ND		1.00	3.04	-.16	.44	1.25	1.84
Smoking makes me feel more self-confident with others.	ND		0.81	3.04	-.04	.60	1.30	1.97
Smoking can be a good excuse to get out of uncomfortable social situations.	ND		0.83	1.48	-.91	.02	.93	1.77

Note. SF = short form; CAT = computer adaptive test. D/ND column indicates if the item parameters were identical in daily and nondaily groups (both), unique to the daily group (D), or unique to the nondaily group (ND). CAT column indicates the rate of item administration for the 10-item maximum condition. Item slope and threshold parameters were obtained through calibrations of the full item banks.

<sup>a</sup>Indicates items that used the following response options: 0 = never; 1 = rarely; 2 = sometimes; 3 = often; 4 = always. All other items used the following response options: 0 = not at all; 1 = a little bit; 2 = somewhat; 3 = quite a bit; 4 = very much.

<sup>b</sup>Indicates items with unique item parameters in both the daily and nondaily groups.

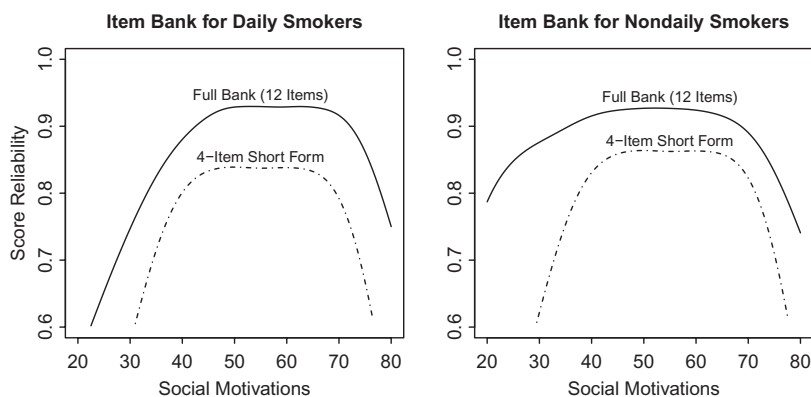
### Social Motivations SF

Examination of candidate item sets indicated that four items were sufficient to reliably capture the content of the social motivations construct. After considering several four-item sets, we selected those items indicated in Table 3 to comprise the four-item SF; the summed score to IRT score translation table for the SF is provided in Table 4. Figure 2 shows the reduction in score reliability when going from the complete item banks (of 12 items each) to the SF. Despite this reduction, the MR of the SF scores remains quite good (0.80). In addition, these scores correlate strongly (0.94 for both daily and nondaily smokers) with those obtained from the complete banks. The results suggest that the four-item SF provides an efficient and reliable measure of the Social Motivations construct.

### CAT Simulations

CAT simulations were conducted on the daily and nondaily smoker Social Motivations item banks. Table 5 provides the

results of simulations that used a standard error of 3.0 (in the T-score metric) as the CAT stopping criterion, which corresponds to a reliability of slightly greater than 0.90, and a range of limits on the maximum number of items allowed to be administered (4, 6, 8, 10, 12). These simulations indicate that the CAT score is highly correlated with the full bank score regardless of the number of items administered. Further, although the CAT achieves acceptable average reliability ( $\geq 0.80$ ) with just four items, an average reliability of 0.90 is reached only when the full 12-item bank is administered. Table 3 displays item administration rates for the CAT simulation condition with a 10-item stopping rule. For the daily smoker item bank, two items (both having stems that begin with “If I quit...”) were rarely used, whereas the remaining items were administered in the vast majority (79%–100%) of simulated tests. There was slightly more heterogeneity in the frequencies of administration for the nondaily bank. One item was used in only a very small number of tests (less than 1%), five items were used moderately often (32%–76% of tests), and six items were administered in almost



**Figure 2.** Score reliability for the daily and nondaily smoker Social Motivations item banks.

**Table 4.** Social Motivations Summed Score to Scaled Score Translation Table for the Four-Item Short Form

Four-item short form		
Summed score	Scaled score ( <i>T</i> )	<i>SE</i>
0	31.7	6.2
1	36.2	5.4
2	39.5	5.0
3	42.3	4.7
4	44.6	4.6
5	46.9	4.4
6	48.9	4.3
7	50.9	4.3
8	52.8	4.3
9	54.7	4.2
10	56.6	4.2
11	58.6	4.3
12	60.6	4.3
13	62.8	4.4
14	65.3	4.5
15	68.0	4.6
16	72.4	5.4

all tests (81%–100%). The items with lower administration rates, as expected, were those with relatively weak discrimination (i.e., with small slope parameter).

## DISCUSSION

As part of the PROMIS Smoking Initiative to develop item banks to standardize the assessment of cigarette smoking behavior and related constructs, we calibrated a core set of items to assess social motivations for daily and nondaily smokers. A total of 15 items are included in these item banks: nine items are common across daily and nondaily smokers, three items are unique to daily smokers, and three items are unique to nondaily smokers. The content of these item banks reflects the multifaceted nature of this construct, which includes expectations that smoking makes social situations more comfortable or enjoyable, that smoking provides a feeling of camaraderie or bonding with other smokers, and

that being in certain social situations increases smoking or the temptation to smoke. The full item banks for daily and nondaily smokers are strongly unidimensional and scores based on these item banks are highly reliable. In addition, these item banks perform similarly across gender, age, and racial/ethnic groups. A separate report in this supplement (Edelen, Stucky, et al.) presents preliminary evidence concerning the validity of the social motivations scores by examining their associations with scores on other PROMIS smoking banks, scores on other measures of quality of life, and patterns of mean scores according to demographic and smoking characteristics.

Recognizing that researchers and practitioners who use these item banks may have specific needs in terms of assessment length, item content, and so forth, an important feature of the item banks is that they are flexible tools that can be adapted to meet these needs. For example, in situations where there is little time available for survey administration or participant burden is a concern, the four-item SF may be an attractive alternative to administering the full item bank. CAT administration provides another good option for assessing the social motivations of smoking in a very efficient manner; results from the simulated CATs indicated that, on average, less than five items are needed to assess this construct with adequate precision using the item banks. A free online tool for administering adaptive tests is available through the PROMIS Assessment Center ([www.assessmentcenter.net](http://www.assessmentcenter.net)). It is also possible to select a tailored set of items from the item banks if one is interested in particular content. Because IRT was used to develop the item banks, these tailored subsets will all provide comparable scores to one another, as well as to the full bank score, SF score, and any CAT. The Social Motivations item banks and SF are available for public use via the project Web site (<http://www.rand.org/health/projects/promis-smoking-initiative.html>) as well as through inclusion in the larger PROMIS library.

Ongoing work on the PROMIS Smoking Initiative includes collecting additional data from a subset of the original calibration sample used in this paper, as well as an additional community-based sample of smokers, to evaluate social motivations and the other smoking item banks in terms of their test-retest reliability, the stability of these constructs over time, and their associations with health care utilization, use of other tobacco products, and quitting history and future quitting plans. Important directions for future research include extending this ongoing work by collecting additional data to examine how



**Table 5. Simulated Adaptive Tests for the Social Motivations Item Banks**

	Maximum no. of items					
	4	6	8	10	12	All items
<b>Daily smokers</b>						
Average items administered	4.00	6.00	7.97	9.71	11.12	12.00
Proportion receiving maximum items	1.00	1.00	.97	.83	.67	1.00
MR	.81	.85	.87	.88	.89	.90
$r(T_{CAT}, T_{full})$	.96	.98	.99	1.00	1.00	1.00
<b>Nondaily smokers</b>						
Average items administered	4.00	5.79	7.21	8.37	9.37	12.00
Proportion receiving maximum items	1.00	.83	.67	.55	.49	1.00
Marginal reliability	.82	.86	.88	.89	.89	.91
$r(T_{CAT}, T_{full})$	.92	.94	.94	.95	.95	1.00

social motivations scores are prospectively associated with quitting behavior and relapse. It may also be useful to develop cutoff scores for identifying smokers who are ready to quit, as well as those who have particular difficulty in quitting and need additional help addressing social barriers to cessation. In addition, it may be useful for smoking cessation programs to gain a better understanding of program effects by examining whether a decrease in the social motivations score serves as an explanatory mechanism for reductions in smoking among program participants. More generally, the Social Motivations item banks described in this paper will provide the field with a reliable and valid tool for assessing this important smoking-related construct in an efficient and standardized manner.

**FUNDING**

This work was supported by the National Institute on Drug Abuse (R01DA026943 to MOE). Additionally, MH was supported by the Institute for Education Sciences with a predoctoral training grant (R305B080016), and LC was supported by the National Institute on Drug Abuse (R01DA030466).

**DECLARATION OF INTERESTS**

*None declared.*

**ACKNOWLEDGMENTS**

The authors would like to thank the PROMIS Smoking Initiative Advisory Group: Ronald D. Hays and Michael Ong, UCLA; David Cella, Feinberg School of Medicine, Northwestern University; Daniel McCaffrey Educational Testing Service; Raymond Niaura, American Legacy Foundation, Brown University; Paul Pilkonis, University of Pittsburgh; and David Thissen, University of North Carolina at Chapel Hill.

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